

REMARKS/ARGUMENTS

Favorable reconsideration of this application as presently amended and in light of the following discussion is respectfully requested.

Claims 1-14 are presently active in this case, Claims 8-14 added by way of the present amendment.

In the outstanding Office Action, Claims 1, 2, and 4 were rejected under 35 U.S.C. § 102(b) as being anticipated by JP 09082665A to Toshiharu; and Claims 3 and 5 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Toshiharu supported by U.S. 4,705,595 to Okudaira et al.

Turning now to the merits, Applicants' invention is directed to a method and apparatus for flattening the surface of a material, such as a semiconductor substrate. Conventionally, chemical mechanical polishing (CMP) has been used to flatten the surface of a substrate in the production of semiconductor devices, for example.¹ As discussed in the Background section of Applicants' specification, CMP is problematic in that it is difficult to avoid the occurrence of damage such as "scratches" on the surface of a substrate due to mutual action between a polishing agent and the surfaces of the substrate.² Applicants' invention addresses this problem.

Specifically, Applicants' Claim 1 recites a method of treating the surface of a material for an electronic device. The method includes irradiating the surface of the material with at least a part of plasma components, while supplying a liquid to the surface of the material, to thereby flatten the surface of the material. Thus, Applicants' claimed invention recites irradiating the surface of a material with at least part of a plasma component while also supplying a liquid to the surface of the material. As discussed in Applicants' specification,

¹ U.S. Patent Publication 2007/0034601 (hereafter Applicants' specification) at paragraph 6.

² Applicants' specification at paragraph [0009].

this combination of plasma treatment and supplying a liquid to the surface of the material has many advantages such as polishing the material, and reducing damage to the surface of the material.³ Thus, Applicants claimed invention can minimize surface scratches caused by conventional CMP processes.

The cited reference to Toshiharu discloses a method of forming a contact plug to fill a connection hole in an insulating film with good flatness.⁴ The method includes depositing a tungsten layer by CVD on an entire surface of the insulating film while filling the connection hole. The tungsten layer is then etched back using a gas containing H and O as its constituent elements, and a gas which can generate fluorine chemical species. As discussed throughout Toshiharu, and in particular at paragraphs 17-18 and 28-29, the gas containing H and O may be H₂O *vapor*. However, there is no discussion in Toshiharu of an H₂O *liquid* being provided to a surface of the substrate being processed. That is, Toshiharu discloses using an H₂O vapor in an etching process, but does not disclose supplying a liquid to the surface of the material as required by Applicants' Claim 1. Therefore Toshiharu does not anticipate Claim 1.

The cited reference to Okudaira et al. does not correct the deficiencies of Toshiharu. Okudaira et al. discloses a method for microwave plasma processing, but does not disclose flattening the surface of a substrate. In fact, Okudaira et al. is cited only for showing the constituents of a plasma as recited in dependent Claims 3 and 5. Therefore, Okudaira et al. does not disclose supplying a liquid to a surface of a material to thereby flatten the surface of the material.

As independent Claim 1 patentably defines over the cited references as discussed above, Claims 2-14 also patentably define over the cited references. In this regard,

³ See Applicants' specification at paragraph 27.

⁴ See Toshiharu at abstract.

Applicants have added new Claims 8-14 to further clarify distinctions over the cited references. For example, Claims 8-14 recite specific pressure ranges of a preferred flattening process and/or that the liquid is liquid H₂O. These claims are supported at least by paragraphs [0047]-[0051] of Applicants' specification, and therefore the additional Claims 8-14 do not raise an issue of new matter. Further, Toshiharu and Okudaira et al. do not disclose these features alone or in combination with the other features of the claimed invention. Thus, Claims 8-14 provide additional bases for patentability over the cited references.

Consequently, in view of the present amendment, no further issues are believed to be outstanding in the present application and the present application is believed to be in condition for formal allowance. An early and favorable action is therefore respectfully requested.

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